Code : C-301

Register Number | m | 5 | 0 | 6 | 0 | 6 | 4 |

III Semester Diploma Examination, November 2008

CIVIL ENGINEERING BOARD

STRENGTH OF MATERIALS

Time : 3 Hours] **[Max. Marks : 100**

Notes : (1) Section – **I** is *compulsory.*

(2) Answer any ***two*** full questions each from Section -- II, III and any ***one*** full question each from Section IV & V.

SECTION – I

1. (a) Fill in the blanks with appropriate word/words . **5 × 1 = 5**

(i) The ratio of shear stress to shear strain within the elastic limit is called _____.

(ii) The unbalanced vertical force to the right or left of the cross section of beam is known as _____.

(iii) The unit of moment of inertia is _____.

(iv) The ratio of hoop stress to longitudinal stress in a thin cylinder _____.

(v) The centre to centre distance between two consecutive rivets in a row is called _____.

(b) Define the following : **5 × 1 = 5**

(i) Young's Modulus

(ii) Centre of Gravity

(iii) Thin Cylinder

(iv) Bending Moment

(v) Polar Modulus

SECTION – II

(Answer any **two** full questions)

2. (a) The ultimate shear stress of a mild steel is 400 N/mm^2. Determine the dia of hole that can be punched through it without exceeding a compressive stress of 800 N/mm^2 in the punch. The thickness of flat is 12.5 mm. **6**

(b) A bar of steel 1500 mm long. For the first 500 mm, it is 20 mm in dia. for the next 500 mm it is 10 mm in dia. and for remaining length it is 5 mm in dia. It is subjected to a pull which produces the maximum tensile stress of 160 N/mm^2. find the change in the length of bar. Take E = 210 kN/mm^2. **9**

3. (a) A copper rod 25 mm dia. is enclosed in a steel tube of 30 mm internal dia. and of thickness 5 mm. The edges are rigidily fixed. The composite bar subjected to an axial pull of 40 kN. Find the stress induced in the rod and tube. **9**

Take : $E_S = 2 \times 10^5$ N/mm^2

$E_C = 1 \times 10^5$ N/mm^2

(b) Due to sudden onset of summer, the temperature has increased by 60 °C. Take E = 2×10^5 N/mm^2. $\alpha = 12 \times 10^{-6}$ /°C. The length of rail is 15 m. Find the temperature stress when (i) Nuts are rigidly fixed (ii) Supports yield by 2 mm. **6**

4. (a) A metal bar 50 mm × 50 mm in Section is subjected to an axial compression of 500 kN. The reduction in length is 0.5 mm over a gauge length of 200 mm and increase in thickness is 0.04 mm. Find the values of elastic constants. **9**

(b) At a point in a strained material the principal stress are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive) on two mutually perpendicular planes. Find the normal stress shear stress, resultant stress across a plane inclined at 60° to the axis of major stress. **6**

SECTION – III

(Answer any **two** full questions)

5. (a) Draw the S.F.D. and B.M.D. for a cantilever beam of 5 m long which carries a point load of 2 kN at the free end and a u.d.l. of 1 kN/m for a length of 3 m from the fixed end. **6**

(b) A simply supported beam of 6 m carries a u.d.l. of 4 kN/m for a length of 2 m from left support and point loads of 5 kN, 4 kN, and 3 kN at 3 m, 4 m, 5 m from the left support. Draw B.M.D. and S.F.D. **9**

6. (a) Locate the centre of gravity of the T section whose flange is 150 mm × 10 mm and web is 200 mm × 8 mm. **6**

(b) Find the M.I. of a channel section 100 mm × 50 mm × 10 mm about the centroidal axis parallel to flange. **9**

7. (a) The M.I. of a beam section 50 mm deep is 69.49×10^7 mm^4. Find the longest span over which beam of this section. When simply supported could carry a u.d.l. of 50 kN/m run. The bending stress in the material is not to exceed 110 N/mm^2. **6**

(b) Design a suitable diameter for a circular shaft required to transmit 100 kW at 180 r.p.m. The shear stress of the shaft not to exceed 70 N/mm^2 and the maximum torque exceeds the mean torque by 40%. The shaft is not to twist more than 1° in a length of 3 m. Take C = 80 kN/mm^2. **9**

SECTION – IV

(Answer any **one** full question)

8. (a) Design a double rivetted double cover butt joint to connect two plates 15 mm thick with 23 mm dia. rivets. **9**

Take $f_t = 120$ N/mm^2

$f_s = 95$ N/mm^2

$f_b = 190$ N/mm^2

(b) A 100 mm × 12 mm plate is connected to another plate by fillet welds around the end of bar and also inside a machined slot as shown in Fig. 1. Determine the size of the weld if the joint is subjected to a pull of 140 kN. Take working stresses for transverse weld and longitudinal weld as 100 N/mm^2 and 80 N/mm^2 respectively. **9**

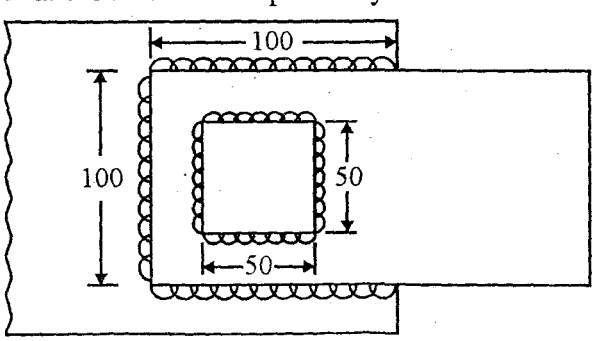


Fig. 1

All dimensio... ...re in mm

9. (a) A boiler shell of 2 m dia. is made up of mild steel plates of 20 mm thick. The efficiency of longitudinal and circumferential joints are 70% and 60% respectively. Determine the safe pressure in the boiler if the permissible tensile stress in the plate section through the rivets is 100 N/mm^2, also determine the circumferential stress in the solid plate section and longitudinal stress through the rivets. **9**

(b) A pipe of 400 mm internal dia. and 100 mm thickness contains a fluid at a pressure of 8 N/mm^2. Find the maximum and minimum hoop stresses across the section. **9**

SECTION – V

(Answer any **one** question)

10. A set of concurrent forces acting at 'O' as shown in Fig. 2. Find the forces P and Q to keep the point 'O' in equilibrium. **12**

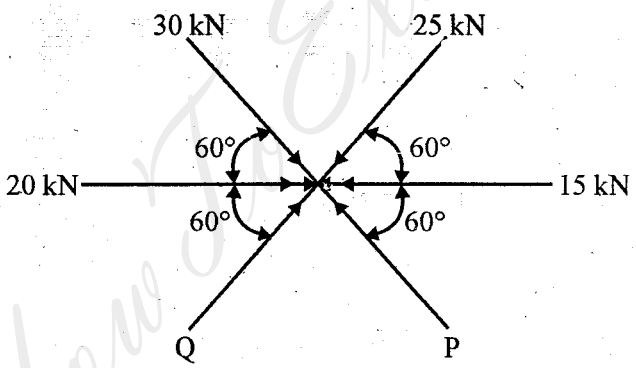
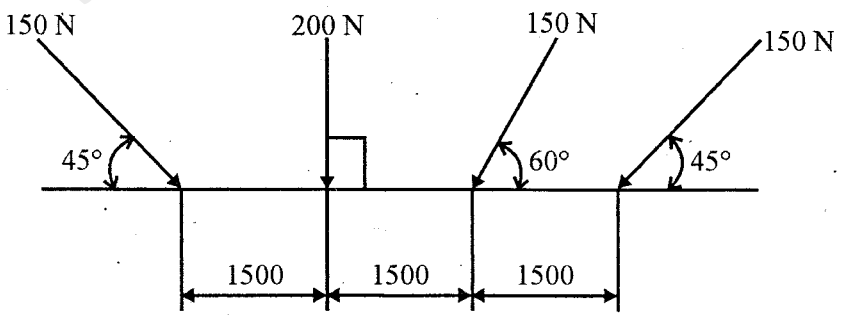


Fig. 2

11. Four forces act on a rigid bar as shown in Fig. 3. Find the value and position of resultant of these forces graphically. **12**



All dimensions are in mm

Fig. 3